Nutrients and Water Quality: A Region 8 Collaborative Workshop

Wastewater Nutrient Removal, Sustainability, and Permitting

Wastewater Treatment Capabilities

Sustainability

Nutrient Discharge Permitting

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Numeric Nutrient Criteria and Limits of Wastewater Treatment Technology[1]

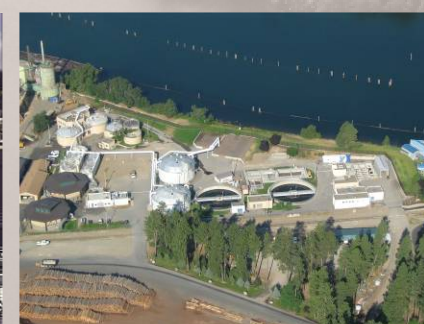
Parameter	Typical Municipal Raw Wastewater, mg/l	Secondary Effluent (No Nutrient Removal), mg/l	Advanced Wastewater Treatment			Typical In-Stream Nutrient Criteria, mg/l
			Typical Biological Nutrient Removal (BNR), mg/l	Enhanced Nutrient Removal (ENR), mg/l	Limits of Treatment Technology[1], mg/l	
Total Phosphorus	4 to 8	4 to 6	1	0.25 to 0.50	0.05 to 0.07	0.02 to 0.05
Total Nitrogen	25 to 35	20 to 30	10	4 to 6	3 to 4	0.300 to 0.600

[1]*Ignoring Considerations of Variability and Reliability of Wastewater Treatment Performance*

Las Vegas, NV (TP 0.170 mg/l)

Clean Water Services, OR (TP 0.100 mg/l)

Lacy, Olympia, Tumwater Thurston Co (LOTT), WA (TIN 2 mg/l)



Coeur d'Alene, ID (TP 0.050 mg/l)

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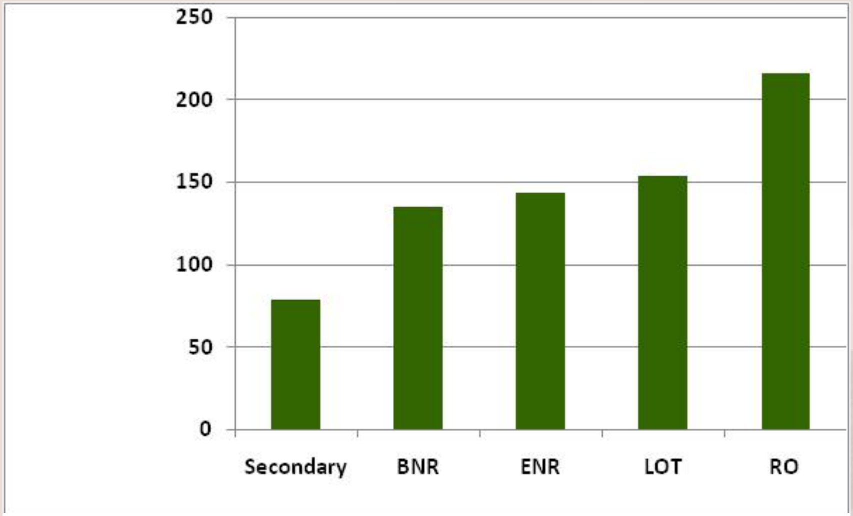
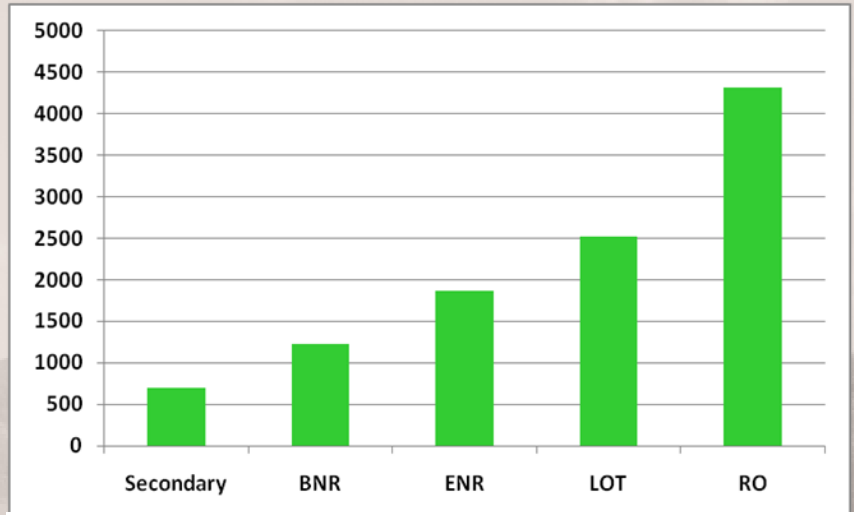
Treatment Costs Escalate Substantially Approaching Technology Limits



Estimated Capital Costs for 10 mgd Capacity (Million $)



Estimated O&M Costs for 10 mgd Capacity ($1,000/yr/10 MG Treated)

Water Environment Research Foundation (WERF) "*Striking the Balance Between Wastewater Treatment Nutrient Removal and Sustainability*" November 2010

1. *Secondary Treatment (No nutrient removal)*
2. *Biological Nutrient Removal (BNR) TP 1 mg/L TN 8 mg/L*
3. *Enhanced Nutrient Removal (ENR) TP 0.1-0.3 mg/L TN 4-8 mg/L*
4. *Limit of Treatment Technology (LOT) TP <0.1 mg/L TN 3 mg/L*
5. *Reverse Osmosis (RO) TP <0.01 mg/L TN 1 mg/L*

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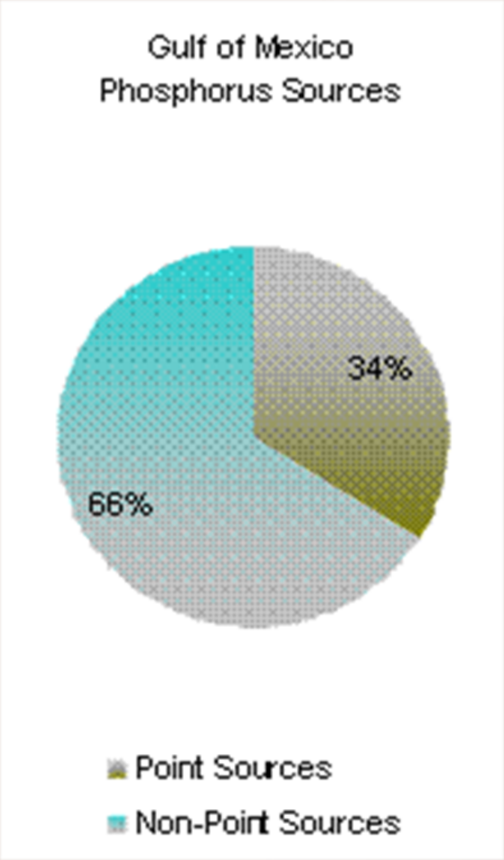
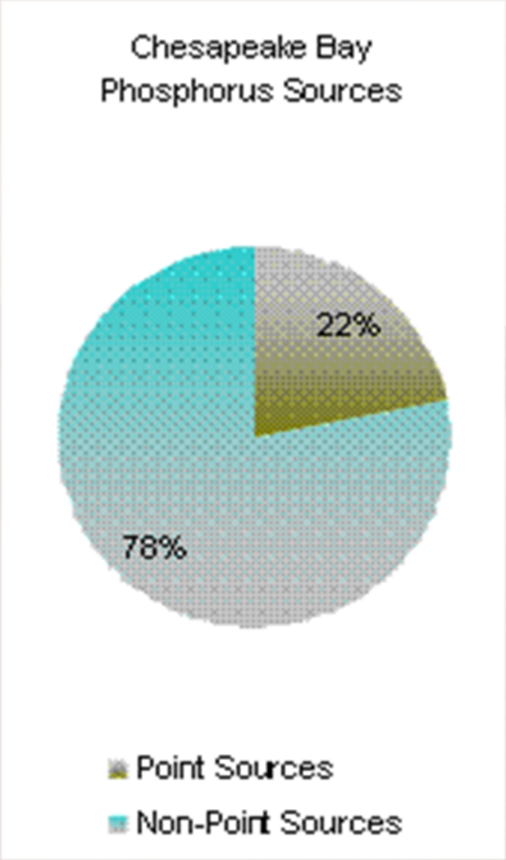
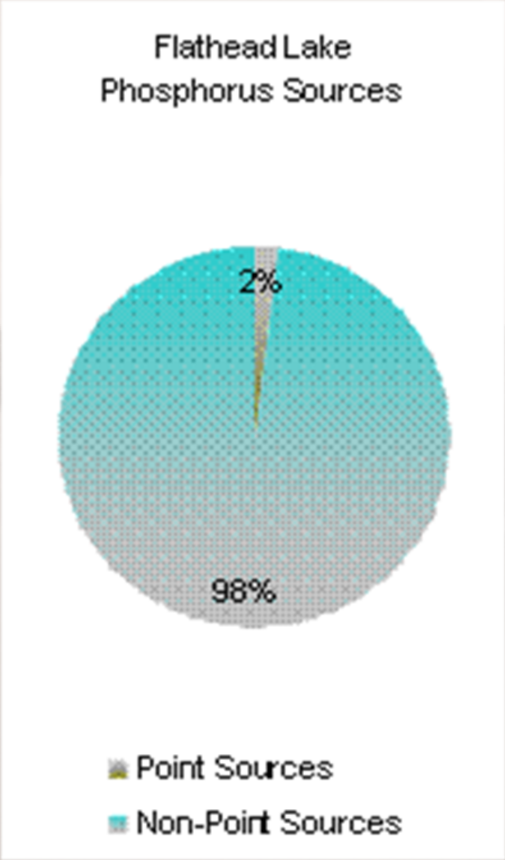
Nonpoint Sources Dominate Many Watersheds







Phosphorus Loading Summaries for Gulf of Mexico, Chesapeake Bay, and Flathead Lake

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Should Kalispell Invest in Limit of Technology Nutrient Removal?

Balance and Sustainability to Protect Water Quality

- ***As Much as We Like Wastewater Treatment…***
  - ***... Advanced Treatment Increases*:**
    - **Capital and Operating Costs**
    - **Energy Use**
    - **Chemical Use**
    - **Atmospheric Emissions**
  - **May Not Always Benefit Water Quality**

Comparison of Point and Nonpoint Source Nutrient Control Performance

Approach	Nutrient Removal Performance	Cost-Effectiveness
Point Source	**80% to 90%**	**$0.50 to $50+ $/lb**
Advanced Treatment		
Nonpoint Source	**15% to 80%**	**$0.50 to $300+ $/lb**
Best Management Practices[1]		

[1]Conservation tillage, grass buffers, detention basins, and wetlands

Sustainability Comparison of Point and Nonpoint Source Nutrient Controls

Approach	Electrical Power	Chemical Use	Greenhouse Gas	Additional Watershed Enhancements
Point Source Advanced Treatment	+50% to +250% over secondary treatment	Alum, ferric, methanol, other carbon sources	+120% over secondary treatment	None
Nonpoint Source Best Management Practices[1]	None	None	Sequesters carbon	Enhanced habitat, aesthetics, sediment reduction

[1]Conservation tillage, grass buffers, detention basins, wetlands

Phosphate Ban in Household Automatic Dishwashing Detergents

- **Beginning with Washington State House Bill 2263, March 2006**
- **Effective July 1, 2010**
  - Maximum 0.5% by Weight
    - Commercial Dishwashing Not Affected

Dishes Still Dirty? Blame Phosphate-Free Detergent --
National Public Radio, Dec 15, 2010

"I looked at a plumber's rear end for about two months this summer sticking out from under my sink. I was just totally frustrated. I couldn't figure out what was going wrong. <u>I'm angry at the people who decided that phosphate was growing algae. I'm not sure that I believe that</u>" **-- Sue Wright from Austin, Texas**

1. **ILLINOIS (SB376)** – Governor Blagojevich signed the bill into law on August 13, 2007.
2. **INDIANA (HB 1120)** – The SDA model including the July 1, 2010 effective date was signed by the governor on March 3, 2008.
3. **MARYLAND (SB766 & HB1131)** – The original bill was signed into law on Tuesday, April 24, 2007. Legislation extending the effective date to July 1, 2010 was signed into law on May 13, 2008
4. **MASSACHUSETTS (SB536)** – SDA model was signed into law on February 21, 2008.
5. **MICHIGAN (Substitute 2 for SB152)** – Governor Granholm signed the SDA model into law on January 6, 2009.
6. **MINNESOTA (Original bills SF1109 / HF1382; Omnibus SF1312)** – Governor Pawlenty signed the bill into law on May 25, 2007.
7. **MONTANA (SB 200)** – Signed into law April 16, 2009
8. **NEW HAMPSHIRE** – Bill was signed into law on July 30, 2009.
9. **OHIO (SB214)** – The bill contains the **July 1, 2010** effective date. The bill was signed on June 3, 2008.
10. **OREGON** – The legislation incorporating the SDA model, SB 631a, was signed into law on June 11, 2009.
11. **PENNSYLVANIA (SB1017)** – The bill was signed into law on May 13, 2008.
12. **UTAH (H.B 303)** – The legislation was signed into law on March 14, 2008.
13. **VERMONT (SB137)** – Governor Douglas signed the bill into law on May 16, 2007.
14. **VIRGINIA (HB233)** – The bill was signed into law on February 22, 2008.
15. **WASHINGTON STATE (HB2263)** – The bill was signed into law March 27, 2006.
16. **WISCONSIN** – The bill was signed into law on November 12, 2009.

Vetoed (1)

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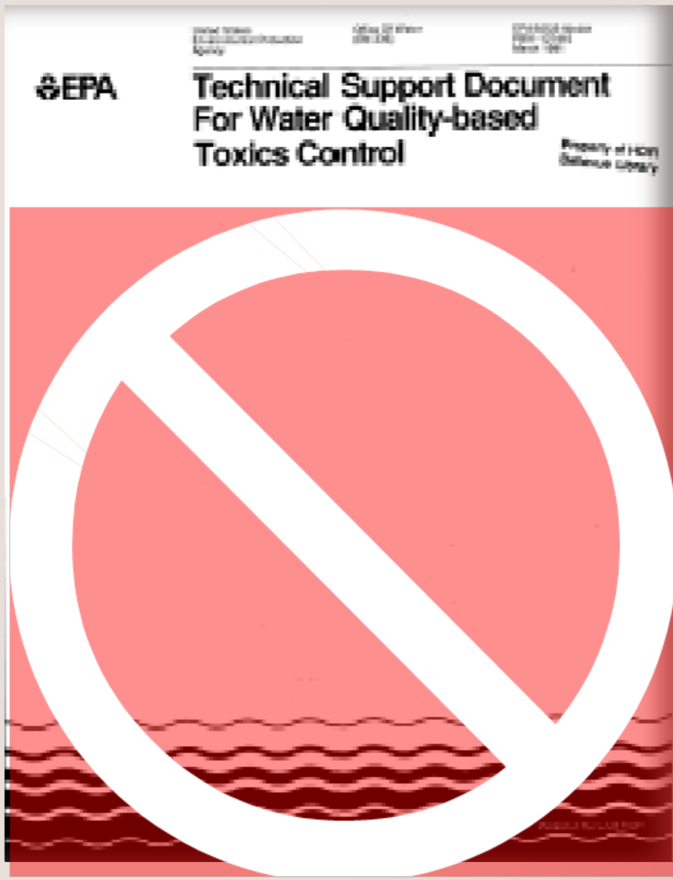
CALIFORNIA (SB 1230) carried an effective date of **July 1, 2010**. It was vetoed by the Governor, at the end of the session, despite industry's support.

Appropriate Discharge Permit Guidance for Nutrients



- **Translation water quality criteria to NPDES to permit limits**
  - **Critical interpretation of water quality Issues**
    - **Pre-formulated permit guidance from EPA and States often focused on toxics**
  - **Appropriate averaging periods**
  - **Variability In low nutrient plant performance**

Over-specifying effluent discharge permit limits will not provide additional water quality protection but may result in compliance issues

Example of Impractical Effluent Discharge Permit Requirements Below Limit of Technology

- **Ruidoso, NM**
  - Total Nitrogen
    - 1 mg/L 30 Day Average
    - 1.5 mg/L Daily Max
  - Total Phosphorus
    - 0.1 mg/L 30 Day Average
    - 0.15 mg/L Daily Max

REGION 6
1445 ROSS AVENUE
DALLAS, TEXAS 75202-2733

NPDES Permit No NM0029165

AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Clean Water Act, as amended, (33 U.S.C. 1251 et. seq; the "Act"),

City of Ruidoso Downs and Village of Ruidoso WWTP
313 Cree Meadows Drive
Ruidoso, NM 88345

Post-Construction Effluent Limits – 2.6 MGD Design Flow – OUTFALL 001 Continued

EFFLUENT CHARACTERISTICS		DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS	
		lbs/day, unless noted		mg/l, unless noted				
POLLUTANT	STORET CODE	30-DAY AVG	7-DAY AVG	30-DAY AVG	7-DAY AVG	DAILY MAX	MEASUREMENT FREQUENCY	SAMPLE TYPE
Flow	50050	Report MGD	Report MGD	***	***	***	Continuous	Totalizing Meter
Biochemical Oxygen Demand, 5-day	00310	651	976	30	45	N/A	1/Week	6-Hr Composite
Total Suspended Solids	00530	651	976	30	45	N/A	1/Week	6-Hr Composite
E. coli Bacteria (*1)	51040	N/A	N/A	126 (*2)	N/A	410 (*2)	1/Week	Grab
Cyanide (WAD) (*4)	00718	Report	N/A	Report	N/A	Report	Once/Quarter	24-Hr Composite
Total Nitrogen ,Ti <13°C (*5, *6, *7)	00600	<195.2	N/A	<9	N/A	< 9 (*8)	Once/2 weeks	24-Hr Composite
Total Nitrogen, Ti ≥ 13°C (*5, *6, *7)	00600	<130.1	N/A	<6	N/A	< 6 (*9)	Once/2 weeks	24-Hr Composite
Total Nitrogen (*5, *15)	00600	21.7	N/A	1	N/A	1.5	Once/Month	24-Hr Composite
Total Phosphorus (*10)	00665	2.2	N/A	0.1	N/A	0.15	Once/Month	24-Hr Composite
Total Thallium (*11)	[illegible]	0.37	N/A	[illegible]	N/A	[illegible]	[illegible]	24-Hr Composite
TRC (*12)	50060	N/A	N/A	N/A	M/A	19 ug/l	Daily	Grab

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Nutrients Differ From Toxics

Nutrients

- No Immediate Impact
  - Aside from Ammonia
- Watershed Scale Impacts
  - Nutrient Enrichment Leads to Aquatic Growth
- Algal Response Over Longer Periods
  - Longer Averaging Period Appropriate for Nutrients
  - Seasonal or Annual Averages Appropriate
- Treatment Technology
  - Variability at Low Levels in the Best Technologies

Toxics

- Acute and Chronic Impacts on Aquatic Life
  - Chlorine, Metals, Organics
- Near-field (mixing zone) and Far-field (watershed) Impacts
- Long Term Response
  - Average Limits
- Short Term Response
  - Maximum Limits Required
- Treatment Technology
  - Available Technology to Prevent Excursions

Summary

- Nutrient Management is Important in Many Waterbodies
- Appropriate Nutrient Effluent Limits Should be Based On:
  - Water Quality Response
  - Capabilities of Treatment Technologies
  - Balanced Considerations of Sustainability
- Over-specifying Effluent Limits Provides No Additional Water Quality Benefit
  - But May Result in Permit Compliance Issues